CANADIAN GEOGRAPHICAL JOURNAL

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MARKET DAY AT FREDERICTON
Photo by Madge Smith

—by a Lady

"LOOK," she said to us, politely but very firmly, "you are making me just a bit tired!"

"Tired?" we said, lifting a surprised brow. "You mean you don't find this Buick comfortable? That these big soft seats and gentle coil springing . . ."

"The seats are dreams of comfort," she interrupted, "and your all-coil springing, or whatever you call it, is everything you say it is and more.

"I mean you've just got the wrong slant on how *we women* look on this Buick!"

"Wrong slant?" We *were* astonished. "Why, its style—its smartness . . ."

" 'Fresh as a new bonnet,' " she quoted back at us. "And it surely does look like what cars will be in the future—I certainly hope.

"But do you think that's *all* we women are interested in? Don't you think *we* like power and steadiness and easy handling too?

"You talk as though only a *man* likes to go zooming up a steep hill without having to shift all the time!

"You sound like you think a woman wants to be bounced around like a baby on his grandpa's knee because her car's too light to hold the road!

"To hear you talk, one might think we girls never park a car. Why, one of the things I like best about ours is the way I can slip it into a parking spot at the grocer's without wearing myself out tugging at the wheel.

"My point is a woman doesn't think about a car just as she does a new hat! *Of course* we want style—good style that will stay smart—like Buick's.

"But we like Buick because it *does* things for us.

"Because it's big and powerful and roomy and steady without being truck-heavy to handle. Because it holds the road and answers the wheel and stops quick and makes us feel safe and sure of ourselves when we drive!

"That's what *I* like about our Buick—and I'll bet lots of other women do too!"

So many people want Buick, and only Buick, that the demand continues far ahead of our ability to deliver. But this big, brawny beauty deserves your last ounce of patience . . . so while you wait, depend on your Buick Dealer's expert service to keep your present car on the road.

When better automobiles are built

BUICK

will build them

White sidewall tires, as illustrated, available at extra cost

A PRODUCT OF GENERAL MOTORS

H.R.H. Princess Elizabeth and Lieutenant Philip Mountbatten to whom good wishes from all over the world are extended on the occasion of their wedding this month.

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How The Saguenay River Serves Canada

The Manufacture of Aluminum

by B. J. McGUIRE and H. E. FREEMAN

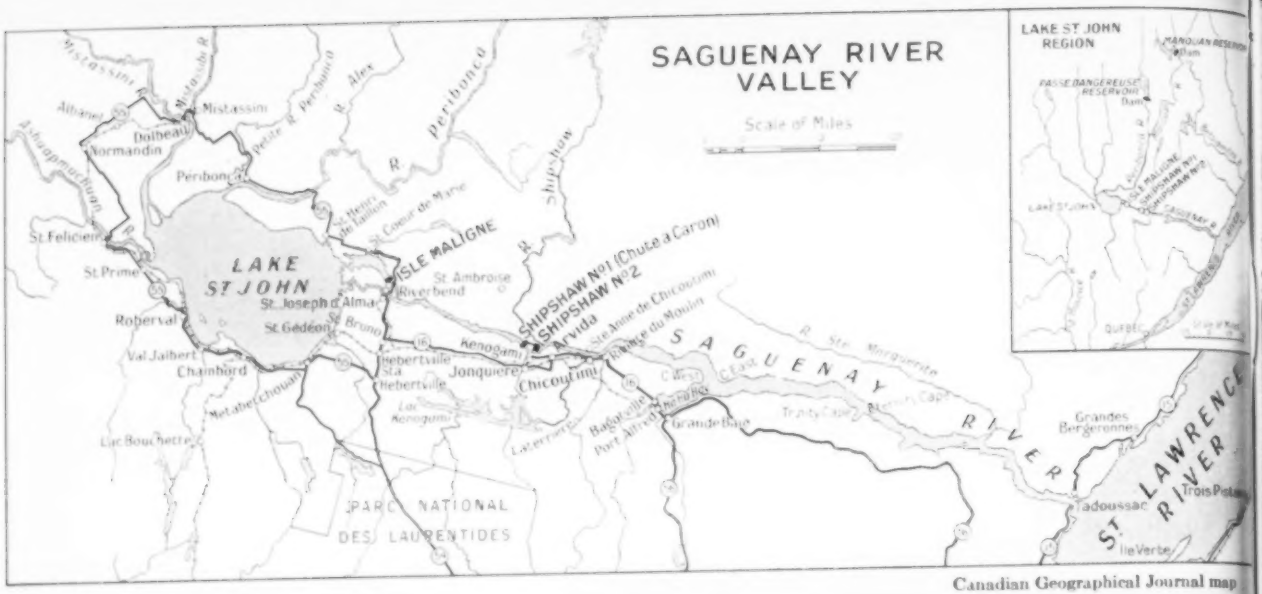
DURING THE WAR many thrilling stories were told about the big Allied bombing planes and how they often came back from daring raids with half their engines dead, their wings and bodies ripped and punctured by anti-aircraft fire. People marvelled that the planes could fly after the punishment they took—and those who marvelled most were the young men who flew the planes for they knew, best of all, how wonderful it was that any machine could be pounded almost to pieces by high explosives and still fly safely home.

Most of the planes flown by our air force pilots were made from aluminum ingot produced in Canada—in the Saguenay Valley in northern Quebec. Many of the big transport planes which now fly quickly and safely to all parts of Canada and the world are made from aluminum from the Saguenay Valley. Here, in this Valley at the city of Arvida, is located the largest aluminum ingot plant in the world. Built by the Aluminum Company of Canada, Limited, it is big enough to produce more than 700,000,000 pounds of aluminum per year—a figure it reached during the critical days of the war when this light, strong metal was needed desperately to make aircraft.

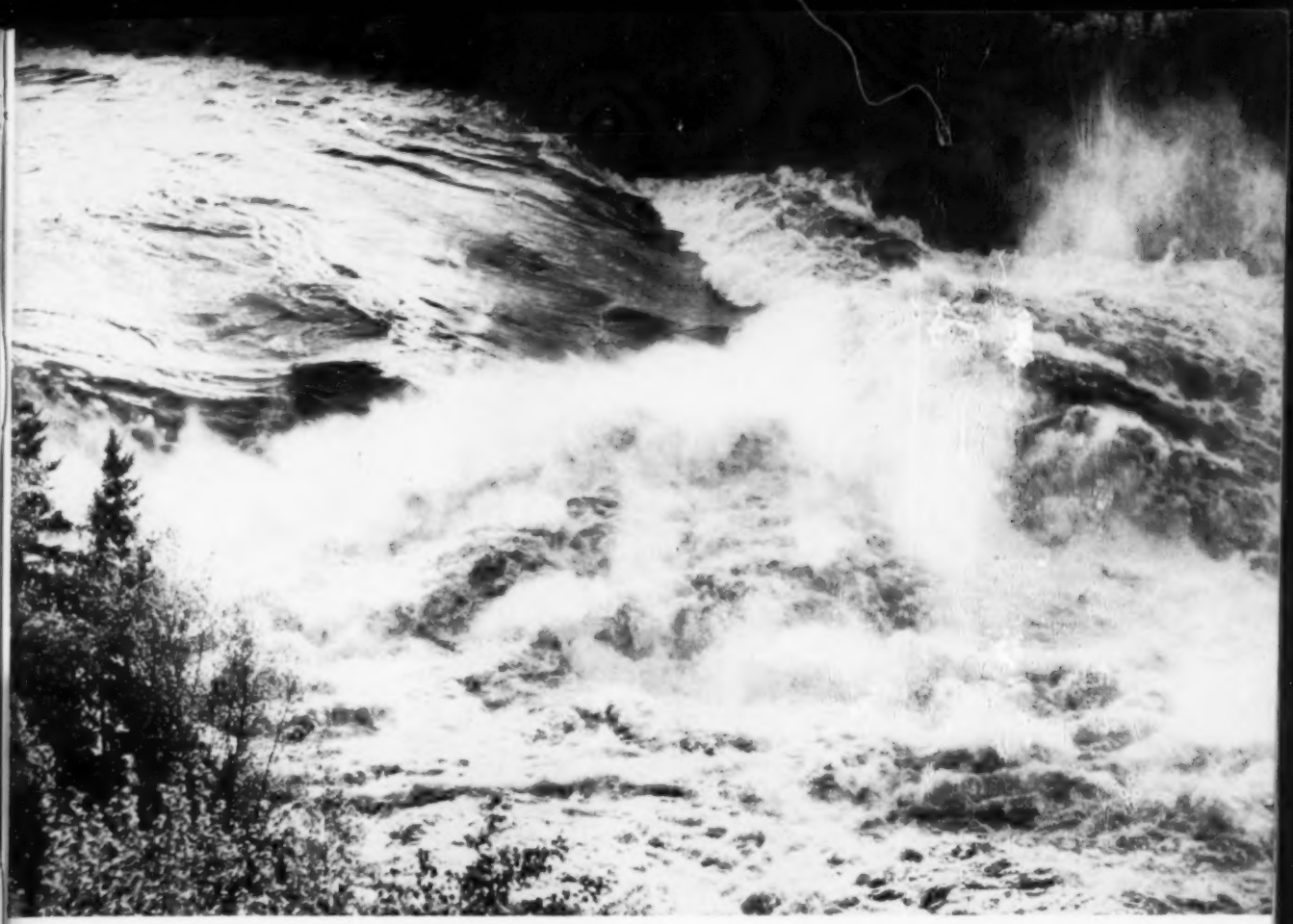
Top left:—Aerial view of a section of the City of Arvida, a model city planned and built by the Aluminum Company of Canada, Ltd. Here 10,000 people live in one of the finest cities in Canada.

Bottom left:—The huge Arvida Works, with its capacity of 2 million pounds of aluminum ingot per day, is 1½ miles long by ¾ mile wide.

At top:—Another section of Arvida, showing the wide streets and spacious lots. In the left foreground is the employees' recreation centre.



Canadian Geographical Journal map



The wasting waters of the Saguenay River have now been harnessed to produce the tremendous quantities of electricity needed in making aluminum.

Geographical Features of the Valley

The Saguenay Valley is an ancient one. Its present form dates from the Great Ice Age when continental glaciers covered the northern half of this continent. In their advance these great masses of ice scoured off the soil and loose rock moulding the face of the country, polished, striated, and grooved the rock surfaces, and deepened valleys. The valley now occupied by the great Saguenay River was thus gouged out to a great depth and its rock walls left steep and smooth, forming one of the most interesting trenches on the continent.

Less than 100 years ago this Valley, located approximately 300 miles northeast of Montreal, was a heavily wooded, scarcely known country with little or no population save a few woodsmen who were beginning to develop a lumber industry. Today it is a community of more than 150,000 people, a busy industrial area, the centre of a great aluminum industry. This change, from an empty land of tall timbers to a rapidly growing industrial centre, came about largely because of the use men made of the unusual qualities of the Saguenay River.

This story is in many ways the story of a river—the Saguenay—which drains the large mountain-ringed valley and runs eastward from Lake St. John to empty into the St. Lawrence River 100 miles below Quebec City. For 30 miles from where the water first leaves Lake St. John, the river is a mad torrent of racing, foaming water, hurrying to get to the ocean through the only exit—the Saguenay. After 30 miles, however, the Saguenay becomes wide and very deep—in fact, one of the deepest rivers in the world. Then the water slows its speed, and flows gently down between steep cliffs to the St. Lawrence.

Left:—The Saguenay River rushes through the 80 mile valley from Lake St. John to the St. Lawrence River.

The waters of the Saguenay River turn the generators in this great Shipshaw Power House, which develops 1,200,000 horsepower.

Making Aluminum Ingot

Now, in making aluminum, three basic things are needed—and the Saguenay Valley has become one of the great aluminum centres of the world because it has them all.

In the first place, many men are needed to make aluminum, and therefore, there must be somewhere for these people to live healthily and comfortably. The Saguenay Valley is such a place. It has room for the homes of those who make the aluminum and fertile farmlands where things can be grown to feed them.

In the second place, it takes great quantities of electricity to melt the ore from which we get aluminum, and therefore there must be plenty of electric power. In fact, the electricity which is used to make only one ton of aluminum would light your house for 15 years! Electricity, huge quantities of it, can be developed from that 30 mile stretch in which the Saguenay River is a rushing torrent, hurrying with almost irresistible force down to the wider, deeper, part below. Fast water like that will turn the wheels which move the generators in power stations, and the generators produce the electricity. Because electricity cannot be transmitted economically more than 200 miles due to losses or leakage on the way, the water power of the Saguenay River was wasted until a use was found for it in producing aluminum.

The third thing necessary to make aluminum successfully is some means of bringing the raw materials close to the factory; and some means of taking the manufactured aluminum away to wherever it is to be used. The lower part of the Saguenay River provides that means, for its deep, quiet stretches form a water highway over which ocean ships can sail to freight raw materials or manufactured goods.

Right:—Port Alfred, on the Saguenay. To this inland port come over 400 ocean freighters each year carrying the imported raw materials for aluminum production.

This is particularly important to the aluminum industry because to make this metal requires bauxite ore which is mined in British Guiana in South America, cryolite which comes from Greenland and coke made at oil refineries in Texas and elsewhere. When bauxite arrives at Arvida it is treated to make a white powder that is called alumina and looks like salt. Then all the materials go into a large, rectangular steel pot. The coke goes first to line the pots and form conductors for electricity. Then comes the cryolite which soon dissolves because of the heat from the electricity. Then comes the alumina and it soon becomes a red-hot liquid. After many hours, the aluminum is deposited in the bottom of the pot and is then drained out. But, since Canada has none of these materials, all these things must be brought to the Saguenay Valley and the aluminum taken away.

The Early History of the Valley

And so, Nature gave the Saguenay Valley many things it needed to become a great aluminum centre. But men with brains and daring and farsightedness first had to develop the assets of the Valley so they could be used in the way they are today. Many men saw the Saguenay Valley before somebody realized that it could be made into a place to manufacture aluminum.

The French explorer, Champlain, saw it early in our history. This first white man to travel up the river thought he might find gold and jewels there. After Champlain came the missionaries—they saw it as a water highway over which they could travel to Christianize the Indians. The fur traders saw it, and used it to carry their pelts to markets at Quebec and Montreal. An Englishman, William Price, saw it as the place where he could cut wonderfully tall, straight trees for masts in the sailing ships of the Royal Navy. Then a group of 21 men (called the Society of Twenty-one) saw it as a prosperous farming country and moved in its first permanent settlers. All of these people saw the Saguenay and they all did

Making aluminum electrical conductors. Most of the world's transmission lines are aluminum.

something to bring closer the great future ahead of the Valley.

The Discovery of Aluminum

Yet the event which really brought about the greatest change in the Saguenay Valley took place in 1886, in the little town of Oberlin, Ohio, in the United States, more than 1,000 miles away. There a young man, Charles Martin Hall, learned how to make aluminum cheaply. By making it cheaply he was able to make it plentiful and, for the first time, really useful.

With so much aluminum around us today it is hard to imagine that 75 years ago it was almost as scarce and expensive as gold—in spite of the fact that, even in those days, aluminum was known to be the most plentiful metal in the earth's crust. Although this light, strong metal is obtained in most abundance from an ore called bauxite, there is a certain amount of it in the ground everywhere. The vegetables we eat contain a high percentage of aluminum absorbed from the soil while growing in the garden. But the secret of getting aluminum out of its ore was so well hidden by nature that for years producing aluminum was a very expensive undertaking—in fact, it cost hundreds of dollars to make a pound of it.

This was the situation when young Charles Martin Hall was a student at Oberlin College. Everybody knew the metal was in the ground; but no one knew how to get it out cheaply. Young Charles Martin Hall decided he would try. So, when he finished school he built a laboratory in his father's woodshed and began experiments.

Now most scientists are older men—men who have studied long and carefully and gathered a great wealth of knowledge. Charles Martin Hall was a young man, just out of school, but he didn't let this fact discourage him. He went to work—and kept working until he had found what he wanted, a better way of making aluminum. He was only 22 when he made the discovery.

The Uses of Aluminum

What this discovery means becomes apparent when you look around. Overhead are the great all-aluminum planes which will fly to any part of the world in a few hours; the new, fast, stream-lined trains use great quantities of aluminum; automobiles, buses, trucks and bicycles need a great deal of it.

Aluminum wires carry the electricity which lights the streets, heats the homes and keeps the motors running in the plants. Your radio has many aluminum parts; aluminum pots and pans are found in most kitchens; aluminum is used in the manufacture of washing machines, refrigerators, sewing machines, vacuum cleaners, outboard motors—in fact, there are few places where aluminum is not needed today. Even houses are built from this metal. Aluminum paint and aluminum foil are very useful in many different ways.

The reason aluminum is so useful is that it is light, but strong—as strong as structural steel but only one third as heavy. It does not rust. It can be made very soft or extremely hard and brittle. It is, in truth, a very valuable servant of man in this twentieth century.

The Beginning of the Industry

When Charles Martin Hall made his discovery he had to form some sort of organization to manufacture and sell the metal. Although many difficulties were encountered, within fifteen years of his discovery several plants were operating in the United States and one had been opened in Canada at Shawinigan Falls, Quebec.

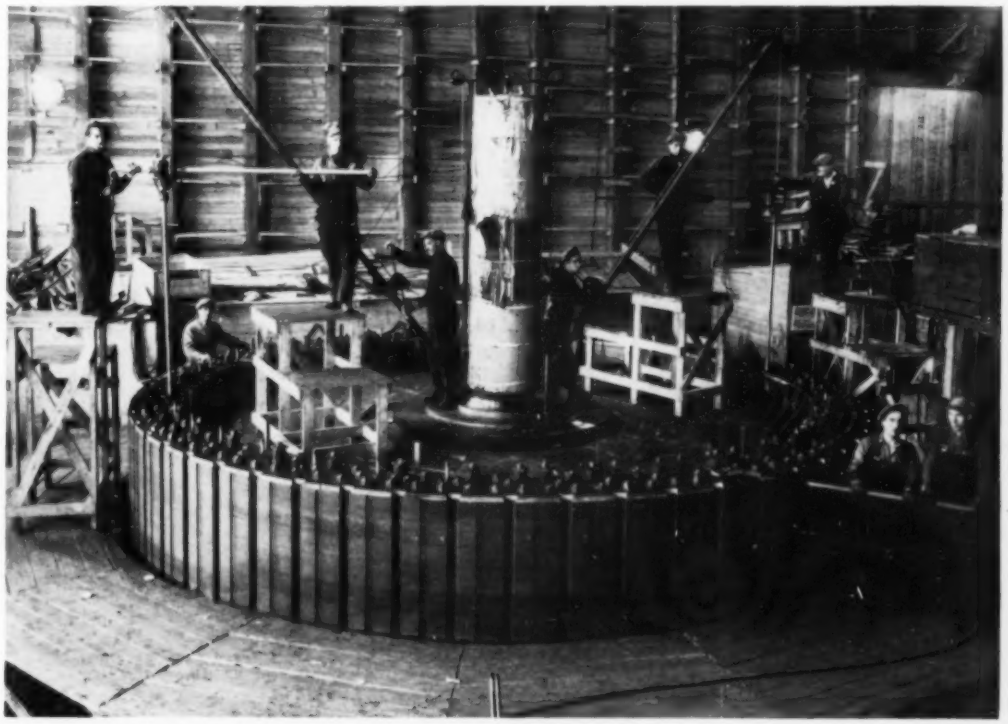
Although aluminum entered the service of mankind thousands of years after metals like iron, copper, lead and zinc, its popularity grew rapidly. It is not surprising that before long the plant at Shawinigan Falls could not produce enough aluminum to meet the needs of the times. Enterprising people began to seek another place where they could build a new plant—and they looked towards the Saguenay.

The Manufacture of Electricity

In order to understand how the Saguenay River—or any other river—can be useful in making electricity it is necessary first to understand how we get our electricity. Usually it is made by a generator containing a huge wheel in which a series of magnets are turned at a terrific speed very close to metal coils. The electric current results from the action between the magnets and the coils.

Where does water come into the picture? Well, you may have stood in a fast moving stream and noticed how the running water tugged at your feet. The water was exerting what is called force against your feet and legs. It exerts force because it is heavy and it is moving. If there is enough of it and it is moving fast enough, the force of it will sweep your feet from under you and carry you away.

It requires a great deal of force to turn the magnets making electricity in the big



Installing one of the twelve generators in the No. 2 Shipshaw Power Station.

The Shipshaw Power Development, completed in record time during World War II. The two power houses, one at each end of the 1¾ mile long canal, have a total capacity of 1,500,000 horsepower—about four times the energy used by Montreal.

Below:—Skilfull engineers, courage and daring tamed the wild waters of the river.

power plants throughout Canada. Engineers have figured out a method of using water to develop this force. To do this, they store water behind a high dam. The water is then allowed to fall from this height. The higher the dam, the faster the water is travelling when it reaches the bottom—and the greater the force it exerts; the more water there is falling at this speed, the greater the force, too. So engineers try to get a great deal of water falling from a great height when they need power to turn their generators. Of course, nothing would happen if the water just ran over the dam, so the engineers build great tunnels for it to go through. At the end of the tunnel is a big wheel with curved blades on it, looking much like a paddle wheel. The generator, which actually makes the electricity, is attached to this wheel so that when the wheel turns the generator turns too. When the water comes through the tunnel it strikes the paddle wheel, causing the wheel to spin around. As the water continues to rush through the tunnel the wheel continues to spin, causing the generator to turn and make electricity. So the force of the water is used to make electricity—and the force of the water is determined by the volume of water and by the height from which it falls.

The first power house on the Saguenay. Built in 1926 this power house at Isle Maligne develops 540,000 horsepower and provides power for new industries.

Since Nature supplies the water there is usually—but not always—a steady flow of it available to keep the generators singing.

Taming the Saguenay

Now when the engineers first looked at the Saguenay River they saw a fast foaming river, with the water swirling and plunging along in a roaring torrent. The reason it was travelling at such a speed was, of course, that it was running down hill, falling rapidly. In a space of about 30 miles this river falls 330 feet. Seeing this the engineers realized that if they could dam the river they could raise the water to a great height and then let it fall—this time through man-made tunnels where the force of the water could be put to work, making electricity. In many ways the Saguenay was just the kind of river electrical engineers like to see. But, to some, it looked just a little too good. The water was going so fast and the river-bed and river banks were so rocky, that many engineers shook their heads when they talked about blocking it with a dam. Some said it could not be done. Others said it could—and they decided to try it.

Taming the great Saguenay River, harnessing its water power so that it could be useful to man is one of the most thrilling stories in the development of Canada. It is a story of men of vision, courage, scientific training and exact workmanship—a story of men who could use the wisdom of the ages together with concrete, steel and dynamite to tame a racing torrent.

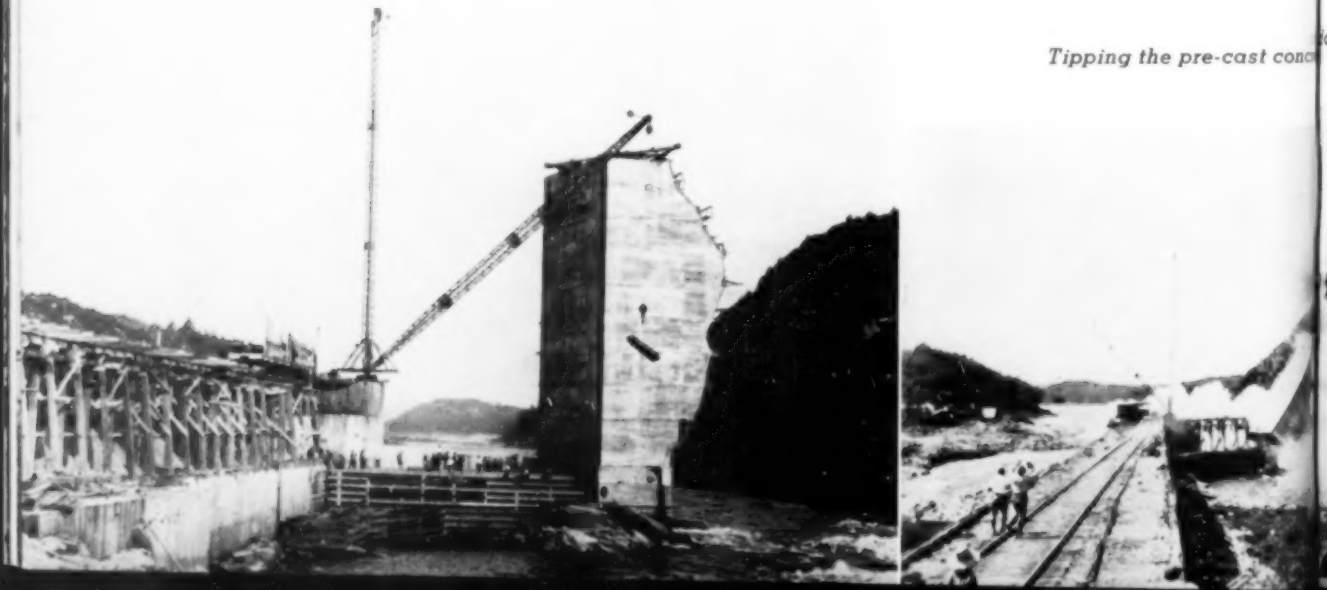
Countless stories could be told of the struggles of these men to bring the Saguenay River under control but one will, perhaps, illustrate the difficulties they conquered. About twenty years ago it was decided to begin a power development at a spot on the Saguenay called Shipshaw. Building the first powerhouse was not difficult. But then came the problem of directing the water from its natural river-bed so that it would flow through the powerhouse. For this a dam

View of the tailrace plug which held back the Saguenay River while the second power house was under construction.

was needed and building it was a problem. The water was racing over rocky ground at terrific speed—so fast that it would sweep away everything the engineers placed in the water.

And then the engineers solved the problem in a manner which had never before been tried. On each side of the river bank they built cement piles, called abutments. Here, with good anchorage against the banks, the abutments held. But out in mid-stream the water was going too fast to build anything. So the men took soundings of the river. Soon they knew the exact shape of the river bottom between the banks. Then they designed a dam and on one abutment they built it straight up in the air—more than 90 feet straight up in the air. The structure was so designed that it was held in an upright position by cement blocks, or keys. One side was flat, like the top of any dam; the other side was made the shape of the river bottom. When the dam was built they dynamited the keys which were holding it—and the dam dropped sideways right across the river. For a breathless moment everybody wondered what would happen—and their breathlessness gave way to a shout

Tipping the pre-cast conc *am in*



Construction scene at Shipshaw. Excavation for the No. 2 Power House tailrace is shown at the right.

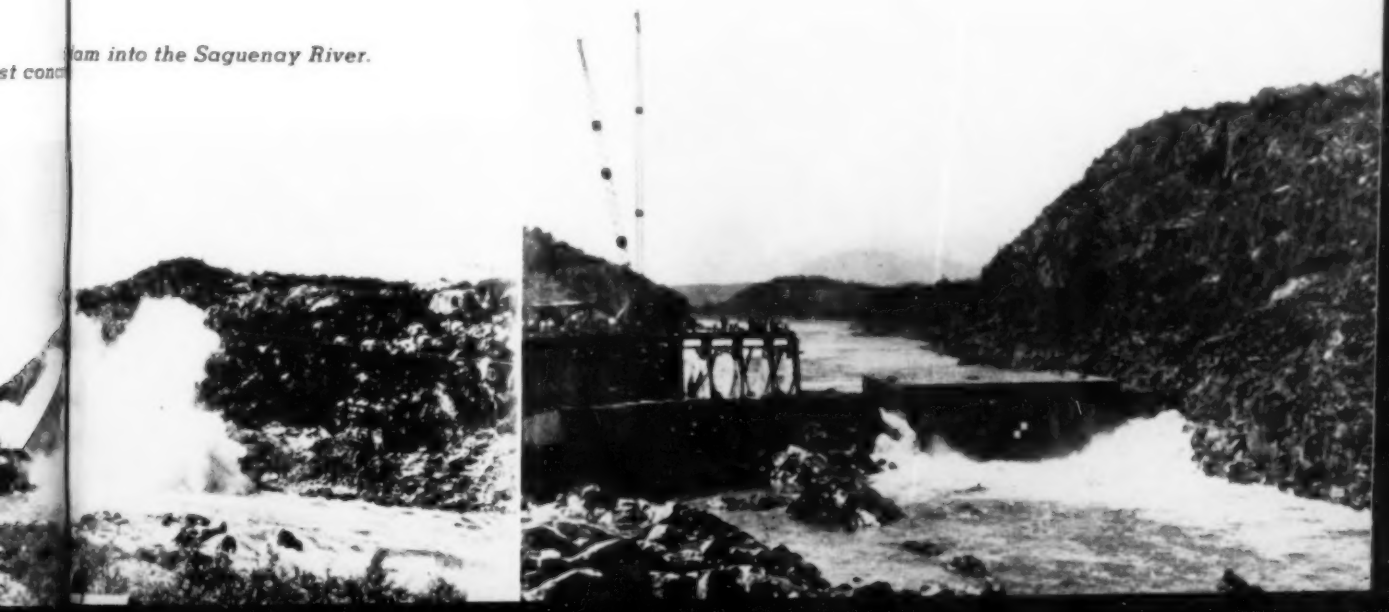
of delight as the dam held solidly and the rushing torrent turned aside to go through the powerhouse.

World War and the Saguenay

Exploits of this kind were to be repeated many times as the Saguenay Valley changed from a solely agricultural area into a vital and growing industrial centre. It is necessary to look back only a few years to the early stages of World War II to find in the Saguenay Valley an achievement which ranks high among the greatest engineering accomplishments of the world. As the real fury of the Axis powers was making itself felt, crushing European nations, cutting off their productive powers from the Allies, it became urgent that vast quantities of aluminum be produced quickly if the aggressor nations were to be halted in their train of conquest.

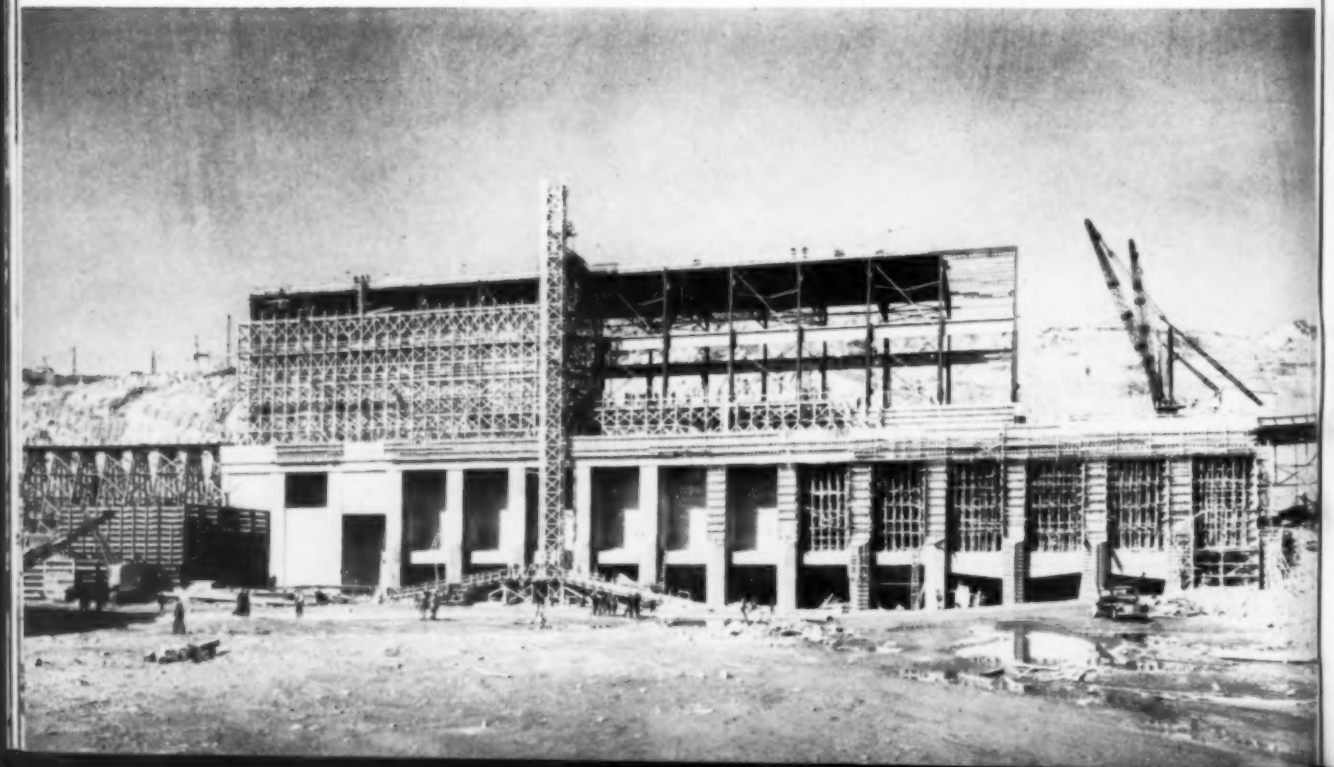
Once again eyes were turned to the Saguenay for here was the source of the electric power needed to produce tremendous amounts of aluminum. While the transportation men began making plans to bring great quantities of bauxite and other raw materials to the Saguenay, while the construction men rushed additions to the production plants, the electrical men turned

...om into the Saguenay River.



Building one of the five huge dams which guide the Saguenay River through the man-made canal.

The partially completed Shipshaw No. 2 Generating Station.



Severe winter weather did not halt progress.

again to another conquest of the rushing power of the Saguenay.

Fortunately they did not have to start from scratch. It took men of vision—and hard-headed business sense—to go into the Saguenay Valley originally and such men do not cease dreaming when immediate needs are met. The first aluminum ingot had hardly come from the production plant in Arvida before the engineers began to make plans for a great production plant supported by vast quantities of electricity. Part of this dream was the development known as Shipshaw Number Two; it was designed to be the final stage of the complete Saguenay River plan. They put these dreams on paper, to be ready when the day of expansion came. That day arrived with startling suddenness when Hitler invaded Poland, when France, Belgium and Holland fell to the Axis. And so, in the hour of need, the plans which had been made for peacetime development sometime in the distant future, came out of their resting places in the company vaults.

Old plans were quickly brought up to date, changes were hurriedly made—and work began on the great project which was to turn the Saguenay River from its course, lead it more than a mile through a channel that was still solid rock, and send it rushing through the tunnels to the new generators at Shipshaw. The work went forward at a terrific rate; a job which would normally have taken five years was completed in 30 months. The Shipshaw generators began to sing on schedule and power went over the lines to Arvida, a mile away. Thus huge quantities of aluminum were produced at a time when the Allies were in desperate need of it.

Because a five year job had to be done in half the time, the cost of the Shipshaw project was greater than would normally

Below—View of the tailrace plug.

Over 80,000 pounds of dynamite w[illegible]used to one explosion. Boulders w[illegible]rown

have been the case—about $40,000,000 more. Money for this project was raised partly from company funds, partly from bonds and partly from shares—which are still owned by the investors. But the Saguenay River with a plant at Isle Maligne, and two plants at Shipshaw, could produce over 2,000,000 horsepower of electricity; the Saguenay Valley turned into the greatest aluminum centre in the world—and the 47,000 men who worked, at one time or another, on the project could take some satisfaction from the fact that every need for aluminum ingot by the United Nations was met on schedule.

Man-made Lakes

Another part of the Shipshaw story is the building of the great dams at Lake

View of the old river channel. On the plateau is seen a part of the construction townsite which housed the workers.

mite was used to blow out the tailrace plug in ders was thrown 1,000 feet into the air.

Scene at the tailrace after the explosion. The Saguenay River returns to its natural channel after having spent its energy passing through the generating machines.

Manouan and Passe Dangereuse. Rivers, as you know, rise and fall during the course of the year; rising in the spring when melting snow has to be drained from the land; falling at times when there is little rain. In the dry season there may not be enough water to turn the generators. When the Saguenay was asked to produce 2,000,000 horsepower it became apparent that even this great and unusual river would need assistance for during part of the year there would not be enough water to do the job. So the engineers went into the north, as far north as James Bay, near the headwaters of the Peribonca River which empties into Lake St. John.

Here, at Lake Manouan, they built a dam which was a tribute to an age of air travel. There were no roads into this area, no rail-

The partially completed dam at Passe Dangereuse.

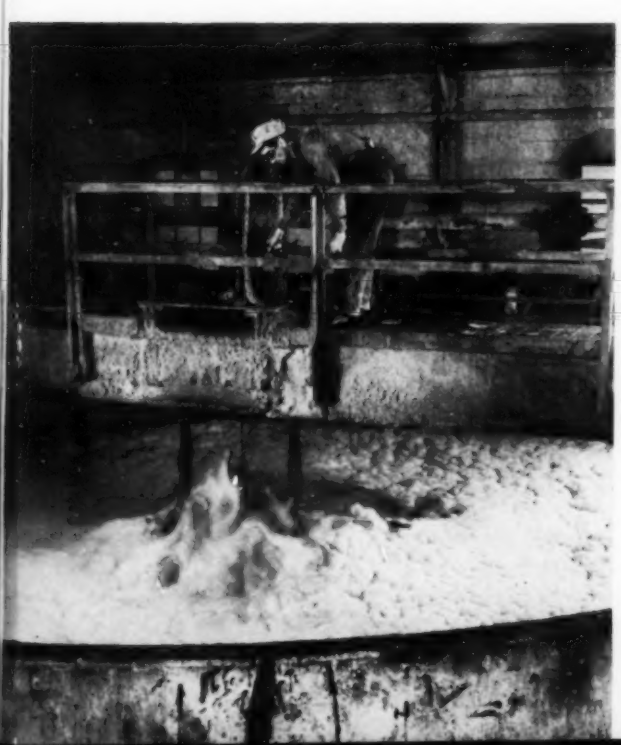
Right:—The control room in the Shipshaw No. 2 Power House where the operation of a small switch directs the flow of hundreds of thousands of electrical horsepower.

Left:—A view of the completed Shipshaw No. 2 Generating Station.

Left, top to bottom:—The aluminum plant at Isle Maligne, on the Saguenay River upstream from Arvida. This plant, much smaller than Arvida, produces aluminum ingot and also made many millions of pounds of aluminum powder for bombs during World War II.

Casting aluminum ingots at Arvida.

Aluminum ingot, stored in the yards of the Arvida Works, ready for shipment.



ways—so everything that went into the dam had to be flown in. Men, food, equipment, horses, cattle, cement—everything needed in a major construction project was flown to Lake Manouan. It was, at that time, the largest air freight undertaking in history. But the dam was built.

A somewhat similar story can be told about Passe Dangereuse, in the same region. But here a road, 143 miles long, was cut through the rugged bush and kept open through the heart of the bitter winters of 1942 and 1943, while construction of the dam was completed.

The results of these efforts were two great artificial lakes, lakes held by the dams, lakes that grew each spring as the snow went out. The water, held behind the dams, was available when, in the course of a normal summer, the water level in the Saguenay usually would fall. Then the gates were opened and the water rushed down the Peribonca River more than 100 miles into Lake St. John and then into the Saguenay. This water kept the level of the Saguenay high and kept the great generators sending power into the aluminum plant across the valley.

The Building of Arvida

Now money and electricity alone can never make any factory go. Men are needed. Men

Left:—One of the scores of four-storey high precipitating tanks in the Arvida works, one of the steps in processing imported ore from British Guiana.

to unload the ore, to tend the machinery, to watch the aluminum furnaces and shape the metal as it is made. And men, with their families, must have houses to live in, and stores to shop at, and something to do in their spare time. When a factory starts in a big city, these things usually are there already. A company in an established city has to find men for its factory, but it does not have to concern itself too much with housing and stores and entertainment.

When a big factory opens up in a new district far away from a big city, however, the story is different. The Aluminum Company of Canada knew that men could not work in its new factory unless they had somewhere to live. So the Aluminum Company built Arvida.

Most towns and cities grow up gradually, in what is known as "haphazard" fashion—somebody builds a house here, somebody else builds another one there, and finally there is a street, then more streets, joined together as best they can be, but built without plan or design. At Arvida, however, the company was able to start right at the beginning and plan for every house and street in the town. That is what they did. That is why Arvida today, a town of 10,000 people, has no slums. Instead, it has trees, fresh air, open spaces, wide streets and clean, good-looking houses.

The homes for workers of the Aluminum Company of Canada, Limited at Arvida are designed to combine attractiveness and usefulness. Most of them are of frame construction, containing six rooms. They are built on bigger lots than in most cities and towns, so that there is plenty of room for lawns, flower beds and vegetable gardens. Home grown flowers and vegetables are plentiful in Arvida, and gardening is encouraged by annual competitions. So it is that the workers of Arvida can be proud of their homes and their town. About one-third of the residents own their own homes, while others rent them from the company at a cost which is much lower than that found in other places.

Fine homes alone do not make a happy town, however. Other things must be added.

Top to bottom:—Workmen's attractive homes set in a grove.

Spacious grounds and wide, paved streets are one of the rewards of town planning.

One of the fine churches serving the City.

Top to bottom:—Arvida houses are modern, well built and comfortable.

Curving streets avoid the monotony common to many cities.

The luxurious Saguenay Inn, a centre of social activities.

Top to bottom:—One of many schools. It is believed Arvida has more school space per capita than any other community in North America.

A manual training class.

A typical classroom. At Arvida ample class rooms permit smaller classes and improved individual instruction.

Above:—Gardening is a thriving hobby, and the warm summers are ideal for garden produce.

Top left:—The beach house at Arvida.

Left:—Outdoor swimming is enjoyed by the workingmen and their families.

Below:—Expert recreational directors and numerous playgrounds are at the service of the youngsters.

Below:—The golf course.

For instance, there must be places for Mother to do the family shopping; there must be places where children can go to school; there must be places where people can meet and enjoy themselves in their spare time. Arvida has these things.

The Arvida Market, a cash-and-carry grocery store, is modern in every way and gives Mother a wide variety of foodstuffs to choose from when she shops for her family. Although probably the most important, the Market is only one of a number of good stores in Arvida.

There are fifteen modern schools in Arvida too, so that every child in the town can be taught in uncrowded classrooms. Of these schools, three go up to the 11th grade and students from Arvida schools are always near the top of provincial examination lists. The company planned the schools just as it planned the houses and stores when it built Arvida. Churches also are a familiar sight in Arvida.

Then there is the Recreation Centre. This is the social centre of the town, where children and grown-ups meet for fun and entertainment after work is done. One part of the big building is used for a complete program of bowling, billiards, chess, and curling. Another part is a hall for band concerts, musical recitals and plays.

Like most smaller cities Arvida offers ample opportunity for sports of all kinds. Skiing, hunting, fishing, baseball, golf, swimming, hockey, cycling and tennis and many other sports are near at hand for everyone —and most people in Arvida take advantage of these opportunities. Arvida has other things that make life more pleasant for workers in the aluminum plant. It has a hospital, a free medical clinic, a modern water supply system and a plant where drinking water is made pure and clean. There are playgrounds in the town, and, of course, a fire station.

All these things were made possible because the company knew that people needed such things to live comfortably. But having built the town, the company turned it over to the residents to run. Arvida has its mayor and councillors, elected not by the company but by the people who live in the town and work in the plant. In fact, the mayor and councillors are often aluminum workers. In addition, there is a city manager whose job is to see that the police department, the fire department, the street cleaning and repair department and all the other parts of a town's management run smoothly and well.

One thing of unusual importance in Arvida —and the surrounding district—is the retirement plan which the company has established for employees. Both the employee and the company contribute to this plan and both

Hockey rink at Passe Dangereuse.

benefit from it. Under it the employee can retire at 65 or before, with a steady income for life. The amount of the pension depends on how long he has worked for the company and how long he has been a member of the plan. The result, of course, is that he feels secure about his old age, worries less about his future, and is inclined to stay on the job, live comfortably, fix up his home and, in general, feel few fears about the future.

So, out of nothing, Arvida has grown into a busy, pleasant town. In many ways it is like other towns, although more beautiful than most. Its main difference from other places is that instead of growing carelessly, Arvida grew by careful planning.

The "Four Horsemen" of Business

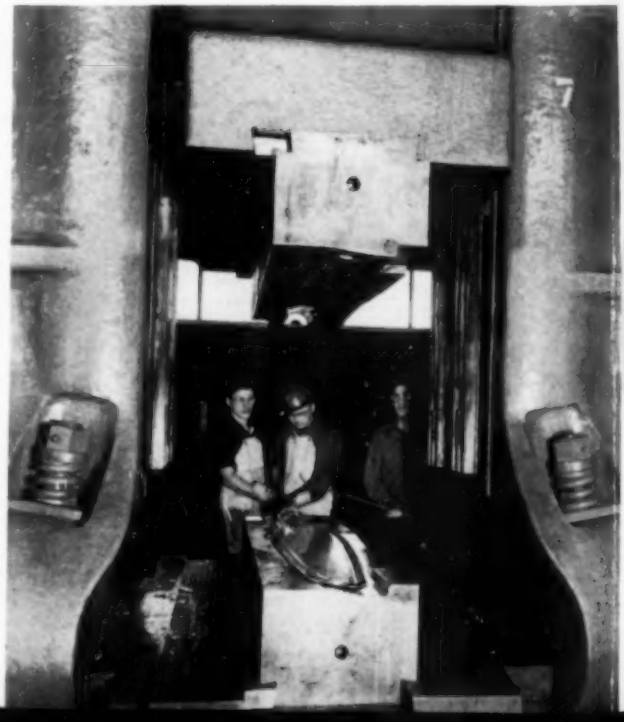
While the unusual character of the Saguenay River has been of great importance in changing this former farming area into a new industrial centre, the river alone does not entirely explain the tremendous growth and development of the district. To get the full picture we must look for a moment at the things which are necessary to make any business successful. When we stop to think about this, we realize that every sort of enterprise depends on four things—be it a big aluminum plant or a corner grocery store. These things are: *money, materials, manpower and customers.*

In the case of the grocery store, three of these things might be supplied by the one person; that is the one man might obtain the money to open and equip the store; he might buy the groceries to sell in the store, and he might be able to run his store all by himself. But he would still have to have customers if he were to stay in business. He would have to get and hold these customers by giving good service, by selling the things the customers wanted to buy, and by selling them at a fair price in comparison with the prices for other goods.

In a large industry, such as aluminum, the picture is a little more complicated, but the "four horsemen" of business—*money, materials, men and customers*—are still the foundation of the whole thing. Here, briefly, is what they mean as far as the aluminum development in the Saguenay is concerned.

Money—This is important, because it takes a lot of money to operate an aluminum plant. It takes money to provide the buildings; to get the equipment; to buy the land; to build the powerhouses; to obtain the raw materials; to hire the people to do the work that is necessary. And all that money does not start to come back until the aluminum reaches the market. There is a long period of getting ready and spending money before any aluminum can be made. This money is usually provided by people who buy shares in the business—and in buying shares they become part owners. The Aluminum Company has many thousands of owners. Some idea of the amount of money required may be obtained from the fact that it cost over $300,000,000 for land, buildings, powerhouses and machinery so that aluminum could be made in the Saguenay Valley.

Materials—It has often been said that the Saguenay is famous as the place where materials from the ends of the earth are gathered into one plant and made into aluminum. Strangely enough, Canada provides none of

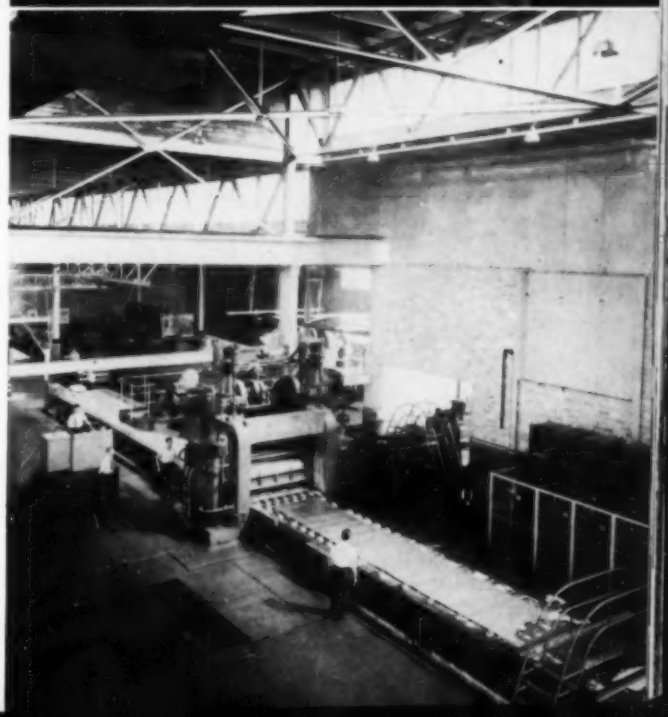


Aluminum from Arvida is used by over 600 Canadian companies. Here workmen at Kingston, Ontario, are forging aluminum propeller blades.

Top:—The research laboratory at Kingston, Ontario, where an associate company of the Aluminum Company of Canada, Ltd. searches for new and better processes to aid the Canadian aluminum industry.

Centre right:—Scientists and technicians in the laboratories at Kingston, Ont.

Bottom right:—The mill at Kingston, Ont., where the Aluminum Company rolls ingot into aluminum sheet.



the raw materials from which aluminum is made. Canada provides only the electricity and the manpower.

We mentioned earlier that aluminum was obtained from bauxite. The bauxite used at Arvida is mined in British Guiana, South America, more than 3,000 miles away from the Saguenay and is shipped to Arvida by boat. Approximately four tons of bauxite are required for every ton of aluminum—so you can see that over 7,000,000 pounds of bauxite per day were required to produce the 350,000 tons of aluminum made in Arvida in the peak war year.

Another important material is cryolite, which is used to get the aluminum out of the bauxite ore. This is a white material from Greenland and it looks so much like ice that the natives of Greenland called it "The ice that won't melt in summer". Still another necessary material is petroleum coke which comes mostly from Texas. So we have

Left:—This man in a Toronto factory is making maple sap pails from aluminum sheet.

Below:—Sand-casting aluminum in one of the many foundries in Canada.

bauxite, cryolite and carbon, all from far-away places in the world, coming to Canada to be made into aluminum because Canada has the electricity needed to do the job. About seven tons of different raw materials —from outside Canada—are required to make one ton of aluminum.

Men—There are few industries where as many different skills and talents are required as in the manufacture of aluminum. There must be the men to plan the whole project; the men to finance it; the engineers to design the buildings, the machinery, the power-houses, the dams; the men to run the ships, to work in the mines, to run the plants. There must be engineers, scientists, chemists, laboratory technicians, machinists, seamen, miners, salesmen, office men, factory men and managers. In fact, practically every skill and training known to man can be put to use somewhere along the 3,000-mile line between raw materials and finished aluminum. As we noticed earlier, it was because many of these men needed places in which to live that the town of Arvida was built.

Customers—Customers are the people who keep the corner grocery store in business; customers are the people who keep the aluminum industry in business. But there is something a little unusual about the customers of the Aluminum Company. The plant at Arvida will produce about ten times the amount of aluminum which can be used in Canada. So the company must sell its aluminum all over the world. England, France, Belgium, Africa, South America—Canadian aluminum finds its way into all these countries and many others. Of course, these people pay for the aluminum—and that is important to Canada because it gives us money with which we can buy things from other countries.

Foreign customers are very important to the people who make a living producing aluminum in the Saguenay Valley. The metal is shipped from this plant in blocks which are called ingots. These ingots must be made into sheets, castings, forgings, extrusions and other things which will make them useful. Changing them from ingot form

into these various shapes is called fabrication. Since the beginning of the war the company has expanded the capacity of its fabrication plants—and built new ones—until it could fabricate five times as much as before the war. But the company produces much more metal than can be used in Canada, so it must find customers abroad for most of its output. This helps to provide jobs and incomes in Canada and helps to provide jobs and incomes in the other countries as well.

Here again the Aluminum Company has the same problems as the man in the corner store. The company can sell aluminum only if it meets the quality and price offered by competitors. In addition to competition between the many aluminum companies in all the principal nations of the world, there is the competition to aluminum itself provided by steel, copper, iron, glass, plastics, wood, etc. Aluminum will be used only if it is the most satisfactory and most economical. Well aware of this the people who make aluminum have worked steadily to lower the price of this metal—just as Charles Martin Hall attempted and succeeded in doing in his experiments. Aluminum was the only metal which fell in price during World War I; the price of aluminum went down between wars; the price fell again during the last great war. In fact, the price of this metal has been going steadily downward since its discovery.

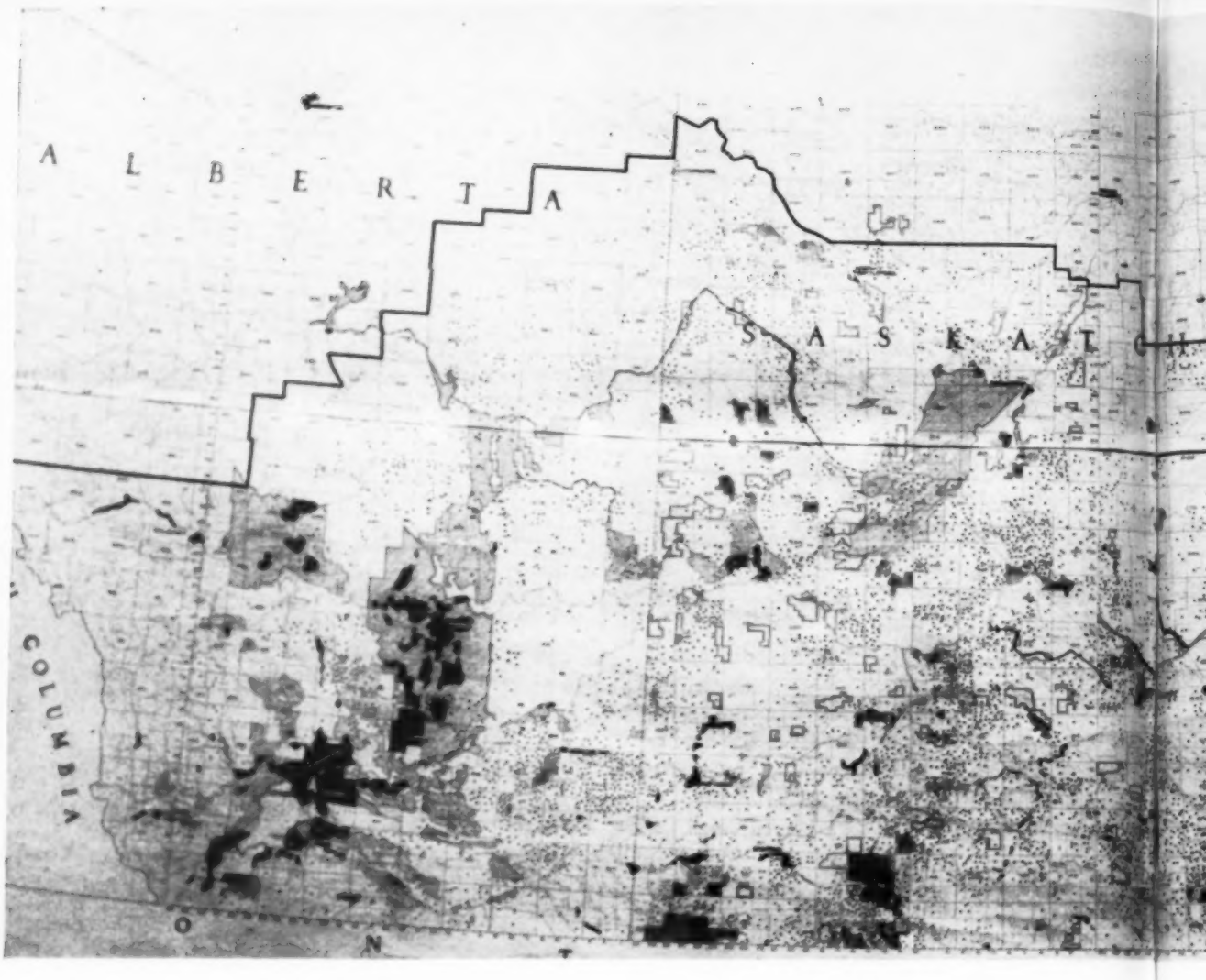
And so we see the full story of how aluminum is made in the Saguenay Valley from materials brought in from widely separated corners of the earth; and of how this aluminum goes out again to be sold all over the world. We can see now that all this has come about, first because the mighty power of a river has been harnessed to make electricity; and second because a big enterprise has brought together the four things necessary in any business project—*money, material, men and customers.*

The Future of the Valley

What of the future of the Saguenay? There appears to be every reason to suppose that this valley will come to occupy a more and more important place in the life of Canada. Certainly more and more uses for aluminum are being discovered.

All this will mean more activity in the Saguenay. The river is capable of producing all the electricity that is required by a large aluminum industry; capable in fact of providing electricity for many new industries in the district. The transportation facilities of the river, together with its electric power, have beckoned invitingly to other industries as they did to the makers of aluminum—and this has increased the activity in the Valley. So it seems that the once agricultural district of the Saguenay, where the French language is still the common tongue, where outdoor ovens are still seen occasionally as evidence of a former way of life, can look forward with confidence to a growing prosperity in the industrial life of the Dominion

Scenes at Lake Manouan, mentioned on page 217.



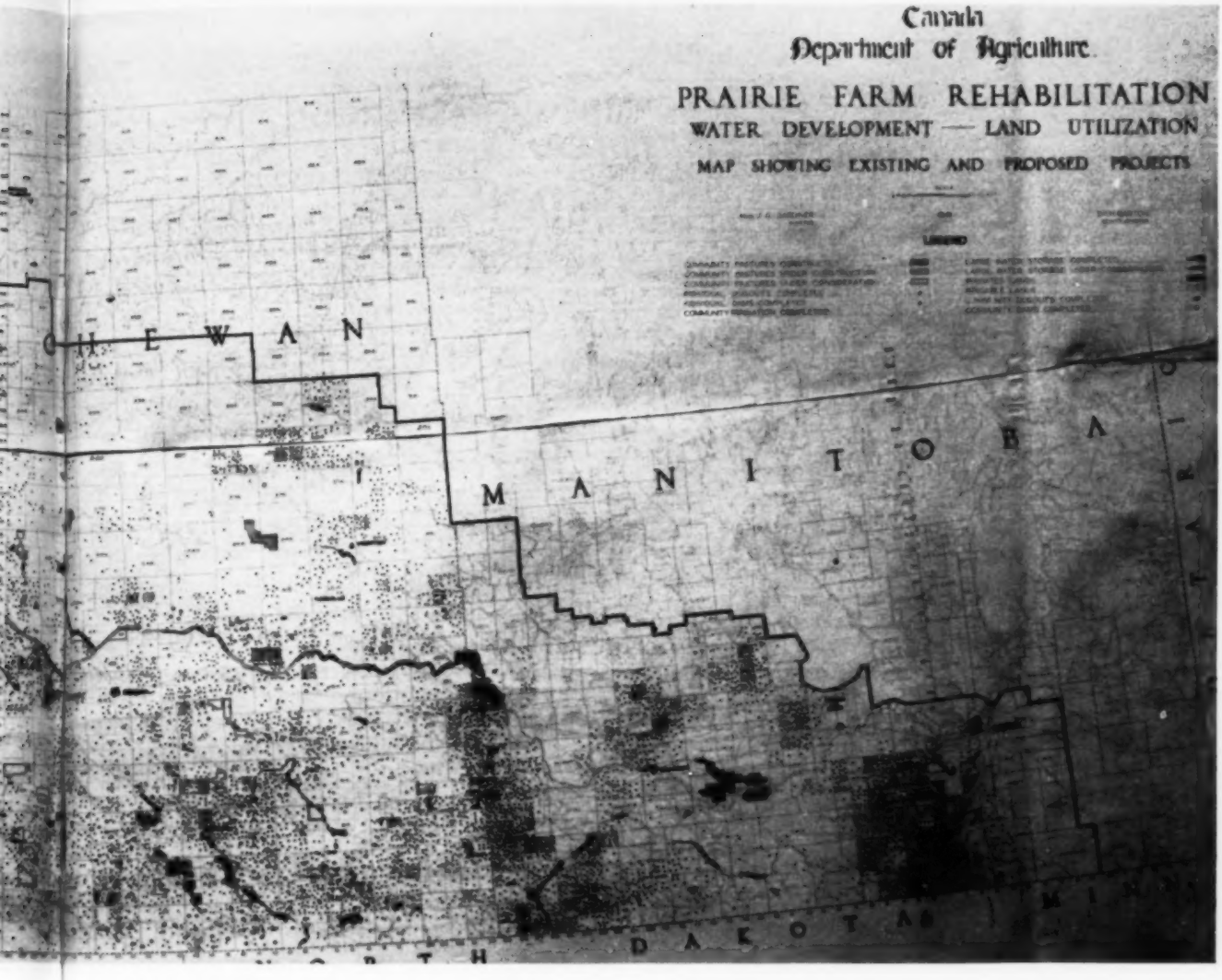
Soil and Water Conservation on the Prairies

by GEORGE SPENCE

IT HAS BEEN SAID that water is liquid gold on the prairies. Certain it is that low and variable rainfall rather than a lack of soil fertility is the limiting factor in crop production over the prairie region. This is strikingly evident in years when the rainfall is plentiful. In such years abundant harvests are garnered, even on the lighter, or inferior, soils. The greatest hazard is, therefore, the climatic hazard. Crop production on the open plains is a continuous battle to conserve the precious soil moisture. This situation has led to the one-crop system of farming now so largely practiced in the low rainfall area. Experience has shown that wheat withstands severe drought better than other grains, which explains, in part at least, why wheat is the dominant crop under dry land conditions.

Top:—Outline of the area covered by the Prairie Farm Rehabilitation Act.

Right:—Operation and maintenance headquarters and warehouse of the P.F.R.A. administration at Moose Jaw, Saskatchewan.
N.F.B. photo



While it is true that the Canadian wheat crop, the great bulk of which has been grown on the open plains, has brought tremendous wealth to the nation over the years, we must not fail to take into account the factors which have made this result possible—factors which do not necessarily ensure sustained long-time production at the former high level. Indeed the very reverse is the case. It is not too much to say that the cropping system and the practices commonly followed to conserve moisture under the one-crop system will in time, if persisted in, not only deplete the native fertility of even our best soils but will also break down the granular structure of that soil. This would cause soil

Top to bottom:—

Threshing with steam tractor.

Light gas tractor which succeeded the Pioneer (below) sparked the revolution in farm power and sent the big steamer and the heavy gas tractor to the scrap heap.

Pioneer Gas Tractor and seven bottom Gang Breaker plough as used in 1911. This tractor has four cylinders and used over 70 cents worth of gasoline per acre as compared to about 14 cents worth for a modern diesel caterpillar tractor. The Pioneer was an advance on the steamer which required a large crew.

Large scale harvesting with combines.

drifting, an ever-increasing problem which, if allowed to continue, would ultimately lead to abandonment of large areas, and could create a national disaster of major proportions.

The challenge posed by prairie agriculture is to evolve a cropping system based on cultural practices that will maintain unimpaired the fertility and productivity of our rich prairie soils. It is fair to say, in this connection, that the problem is recognized by the departments of agriculture, both federal and provincial. Leading farmers and agriculturists have long realized that the practice of laying land fallow for one year, in order to grow a crop on it the next, leaves much to be desired from a soil building and soil conservation standpoint. It is a fact, nevertheless, that in the growing of cereal crops no satisfactory substitute for the fallow practice has as yet had general acceptance. In recent years, with the introduction of "power farming", the practice has been modified to the extent that its most harmful aspects have been eliminated. Surface cultivation and the "trash cover" have replaced the "ploughed" or "bare"

Top to bottom:—

The O. B. Lassiter outfit near Chin, Alberta, consisting of eight tiller combines hauled by a single diesel tractor.

T. R. Melville-Ness photo

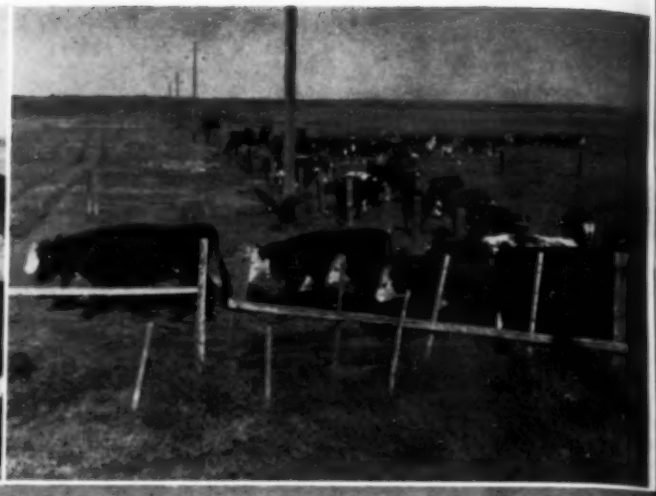
A modern tractor on rubber.

The mechanization of grain handling. Truck in foreground dumps grain into portable elevator hopper which in turn fills the granary.

Newly cultivated land showing how the Noble Blade leaves all stubble and trash on the surface to prevent soil drifting and to catch snow.

fallow. In districts where moisture conditions permit, cover crops have been substituted for the bare fallow.

It will be seen, therefore, that the wealth created from the sale of wheat produced by a "wheat-fallow" system of farming has been created at the expense of the fertility and the structure of the soil on which it was grown. To put this in another way, we have been exporting our soil fertility and selling it by the pound. This system of drawing on Nature's bank account without putting anything back is neither conducive to stable agriculture nor does it add permanent strength to the national economy. The importance of prairie agriculture in the national economy is too well known to need further elaboration here. Wide and general recognition of the necessity for its rehabilitation is conceded and public policy has already been directed to this end. This is evidenced by such agencies as the Prairie Farm Rehabilitation Administration with its cultural, land utilization, and water conservation programs. There is need at the present time, however, for an awakened interest by the general public, together with a more



COMMUNITY PASTURES

Top row:—

Cattle being put into community pastures in the spring, and being rounded up for fall delivery; in the corral following fall roundup, being sorted for ownership; and summer roundup for dehorning and branding.

Centre:—Annual meeting of patrons of the Beaver Hills Community Pasture.

Bottom row:—

Horses wintering on Crested Wheat Grass in Kindersley Community Pasture.

Pure-bred bulls, provided by P.F.R.A. in connection with their improved cattle production program, in community pasture.

P.F.R.A. stockwatering dam in community pasture provides permanent fresh water supply.

Typical dugout provides water where stockwatering dam is not feasible.

thorough understanding of the means which will have to be employed in order to achieve the objective sought. To this end it is important to understand present trends and the long-term effect of these trends. This is very necessary in order to enlist public support for the initiation and development of large scale soil and water conservation projects, which no government, however well intentioned, can carry out without such support.

One of the most notable trends is the change-over from animal to mechanized power on the prairie farm. This change began just before the first great war and has continued progressively over the years until the mechanization of prairie agriculture is now almost complete. This in turn has brought about larger and larger farm units as the efficiency of mechanization improved. This trend has resulted in a corresponding thinning of the farm population.

Farm mechanization had its beginning with the steam tractor. Because of its great weight the operations of the steam tractor were, for the most part, confined to breaking and threshing. A large "steamer" could pull a gang of from six to ten breaker bottoms and, working around the clock, could turn over from 20 to 30 acres of new breaking a day. It was the introduction of the light gasoline tractor, however, which sparked the real revolution in farm power, sent the big steamer to the scrap heap, and changed, for better or for worse, cultural practices over the entire prairie region. The "Waterloo Boy" and the "Titan 10-20" were among the forerunners of the modern light tractor now found in almost every barnyard.

The light gas tractor was not the only significant innovation in farm machinery during that period. The reaper thresher or "combine" was introduced in the mid-twenties, followed shortly afterward by the swather. It was during this period too that the one-way disk came into use. All these machines were complementary to one another and revolutionary in the sense that their coming into use displaced and rendered obsolete other machines and equipment that had been in general use up to that time.

The "one-way" is perhaps responsible for the most revolutionary change in cultural practices in that it relegated the age-old mould-board plough to the scrap heap and brought about the change from the bare

The school house and teacher's residence (left) have to be abandoned in the shift of population from a poor farming area to P.F.R.A. irrigated lands. The land shown below produced only 60 bushels of wheat on 200 acres; dried-out crop is being cut with a mower, raked up and bunched to be used for feed.

ploughed fallow to the practice of the ploughless fallow and the "trash cover". This departure from the long accepted practice of ploughing everything under is an important modification of the bare fallow practice. It has the advantage of protecting the soil from erosion and conserving moisture in the soil, besides returning a greater amount of crop residue to the soil. Just how far this practice will off-set the depletion of the limited organic matter in our prairie soils is something that has yet to be determined. Certainly it is something to which further research should be directed.

Our prairie soils are among the greatest of our natural resources. Consequently, the conservation of that soil is a matter of great national concern. The cultural branch of the P.F.R.A. has undertaken a broad program of research and experimentation directed to evolving cultural and cropping practices which will be based on sound economic and soil conservation principles. In this, together with other things, lies the great hope for the future of prairie agriculture. The development of sound cultural and cropping practices, while tremendously important, are not by themselves the complete solution to the complex problem of a stabilized agriculture in the low rainfall area.

In the early days of land settlement there were no soil surveys or land classification to guide the prospective land seeker. Under the "free homestead" policy land was often taken up without due regard to its quality. Experience has since shown that on much of the inferior or submarginal soil settlers have not been able to make a living.

In an effort to cope with this situation the land utilization branch of the P.F.R.A. was set up, because it was realized that proper land use was an essential part of a rehabilitation program. Broadly, the policy is to stop permanently cultivation of these submarginal, or non-arable, lands which can then be put to their best economic use and developed as community pasture areas. Farmers and stockmen resident in the locality are benefited to the extent that community pasture privileges enable them to keep more livestock, thus providing greater diversification in their farm operations and hence greater security.

The greatest problem (also a part of this rehabilitation plan) was the movement of settlers from the submarginal lands to better lands outside the pasture area. This movement was carried out with a minimum of friction and a maximum of benefit, with a view to enabling the settlers to become self-supporting again.

Under this policy seventy-seven community pastures have been constructed, totalling 1,500,000 acres, requiring 3,700 miles of fence. During the pasture season of 1946 80,000 head of livestock were carried and the total receipts to the national treasury from this source were $200,000.

When appropriate agreements for land control are reached with the provinces concerned, this program of community pasture development and proper land use can be greatly expanded with similar and corresponding all round benefits.

It is recognized that the measures already outlined for the maintenance of soil fertility and land conservation, together with approved systems of land use, while highly beneficial, will not, however, entirely insure the low rainfall area against recurrent crop failure. This is because the high plains are not only subject to low and variable rainfall during the growing season, but are also subject to periodic cycles when severe and protracted droughts, extending over several years in succession, occur. This happened in the thirties. No cropping or cultural practices can conserve moisture if there is no moisture to conserve. Nor can they provide a protective "trash cover" or "stubble mulch" where little or nothing has been grown on the land the previous year.

In such extreme conditions even diversification is not the solution. Livestock has to be fed, or disposed of, often at sacrifice prices. In such circumstances the farmer with a well stocked farm may find himself in a worse position than the exclusively grain farmer. In one year (1936) during the great drought of the thirties, 474,000 cattle were

N.F.B. photo

INDIVIDUAL SMALL WAT

Excavating farm dugouts (left) with large scrapers and (centre) with dragline. (Righ

taken out of the area affected by drought. Many of these cattle were moved under "feeder-freight" policies of the federal government. During this great drought period, too, feed had to be shipped into the area from points as far apart as British Columbia in the west, the Province of Quebec in the east, and the State of Minnesota, U.S.A., in the south. To meet such extreme conditions there is only one solution, namely, irrigation.

While it is true that only a small percentage of the dry land area can be irrigated from the available water supply, it is equally true that these water resources are so situated that they can be put to beneficial use on areas of good land strategically located over the dry plains section of the prairie provinces. This fortunate circumstance adds greatly to the importance of irrigation in another respect, namely, irrigation has a stabilizing effect on farming in the surrounding area. This stabilizing influence extends far beyond the area immediately "under the ditch".

To be more specific, it is known for certain that the P.F.R.A. program for the conservation and utilization of the water resources of the prairie provinces—now well under way—will, when completed, make the low rainfall area self-supporting in so far as feed supplies are concerned, a circumstance that will ensure a more stable and secure prairie agriculture based on livestock.

The water conservation work of the Prairie Farm Rehabilitation Administration falls readily into two divisions, namely, small water development and large water development.

In order to stimulate and encourage the development of small water conservation projects, where topography and other conditions are favourable, financial assistance is given to individuals on a self-help basis, for the excavation of dugouts and the construction of small dams and other works designed to store and utilize surface or run-off water on individual farms. This program also includes larger projects intended for "neighbour" and "community" use. Under this policy a total of 35,000 individual and small community projects have been completed. These projects are scattered here, there and everywhere over the entire P.F.R.A. area.

While the small project is in most demand for stock watering, there has been a marked increase in recent years in the number used for small irrigation schemes, ranging all the way from an acre or two for a garden or feed lot, up to sizable areas of 100 acres or more. It is estimated that a total of well over

Right:—Storage of surface run-off water is an important phase of water development work. The reservoir shown provides water for a garden located below the dam and for stock.

N.F.B. photo

SMALL WATER PROJECTS

ne. (Righ mping water from a dugout to irrigate a farm garden at Maxstone, Saskatchewan.

100,000 acres is now being irrigated by virtue of this small water development policy. Undoubtedly this use of the small project for irrigation will become more general as the farmers in the dry land areas become more water conscious, and consequently more familiar with the many different methods of using water, such as pumping, flood irrigation, and terracing to absorb run-off. Fortunately, the general topography of the area is favourable to a program of small water development in that all over the high plains region there are innumerable draws and runways that afford excellent sites for the construction of reservoirs to trap surface or run-off waters. In short, the activities in connection with small water development are so beneficial and wide-spread as to constitute a first line of defence against the ravages of protracted droughts. The program is, moreover, capable of tremendous expansion.

Large water development as now envisioned by the P.F.R.A. originated with the policy initiated and laid down by the present Dominion Minister of Agriculture, the Right Honourable J. G. Gardiner. This policy was incorporated in the report of the St. Mary and Milk Rivers Water Development Committee as applicable to the St. Mary and Milk Rivers project in Alberta. The policy as enunciated by the Minister provides for the construction of the "main reservoirs" on rivers and streams by the Dominion Government, the cost of which is to be regarded as a non-recoverable expenditure. It has become a generally accepted principle that the total costs of these large irrigation projects should not be charged to the lands imme-

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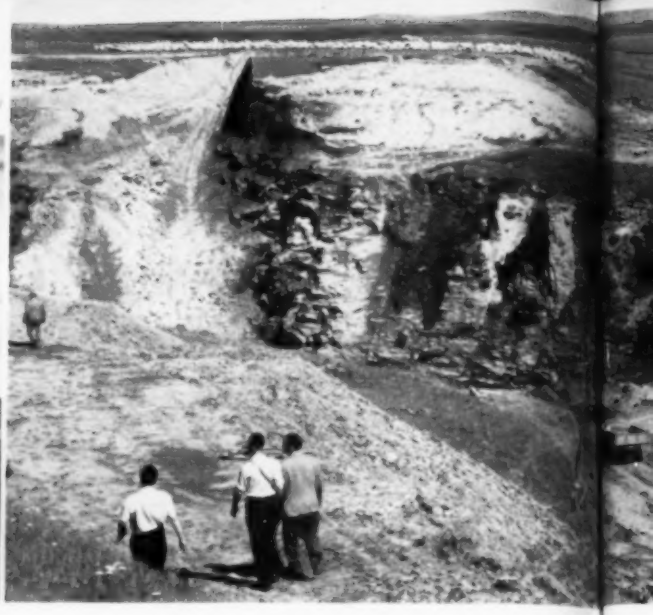
r for

Topographical surveys and engineering studies are fundamental activities in connection with large water development. Engineer in foreground conducting a survey near Elbow in connection with the South Saskatchewan River project.



The East Pothole Coulée dam site of the Sary ar

diately benefited. This principle is set out very clearly and concisely in the report of the St. Mary and Milk Rivers Water Development Committee where it says:

> It is recognized by irrigation authorities and has been proven by the results of completed irrigation projects that, in general, successful operation of large projects is impossible if the entire cost of construction is charged against the irrigated lands. It is also recognized that benefits from irrigation spread widely through various services and functions for transportation, merchandising, processing of farm products and in the manufacture of equipment and supplies utilized on the farm. These benefits accrue (1) To the farmer who lives on the land, (2) To local urban and community centres, to municipalities and the province and (3) To the country at large in increased capital wealth and the maintenance of employment and business activity.

Under this policy a number of large water storage projects have already been constructed and others are under way or in the blueprint stage.

It was not possible during the war years to undertake the construction of large peacetime projects. Fortunately, however, the P.F.R.A. was able to continue essential investigations necessary for large-scale planning with the result that as soon as hostilities ceased contracts could be let and work started on a high dam on the St. Mary River some 40 miles southwest of Lethbridge, Alberta.

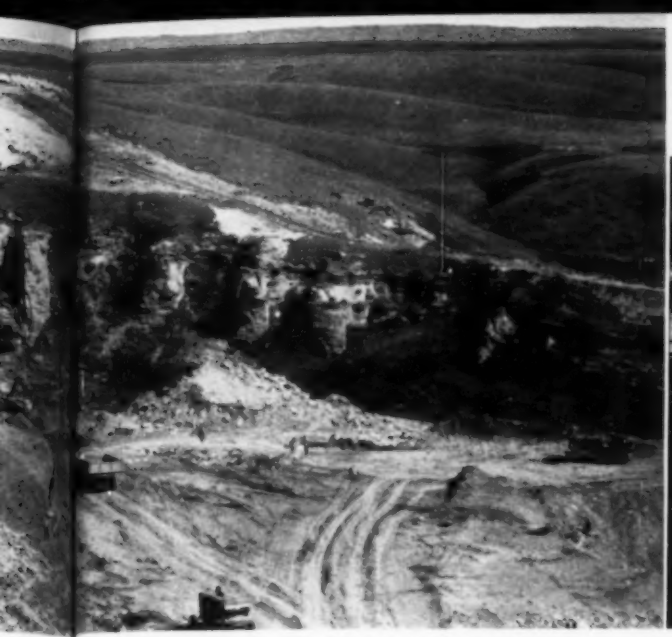
This dam will be a rolled earth fill 200 feet high above its base. The reservoir created by the dam will impound 320,000 acre feet* of water of which 290,000 will be available for irrigation. This project is designed primarily to store Canada's share of the St. Mary

*Note:—An acre foot is the equivalent of one acre of land covered to a depth of one foot.

Aqueduct near Brooks, Alberta, originally built by the C.P.R., irrigates 25,000 acres in the Eastern Irrigation District. It is a mile and three-quarters long and has a capacity of 630 cubic feet per second.

Centre:—Craven Dam, part of the irrigation development of the Qu'Appelle Valley in Saskatchewan.

N. F. B. photo



e of the Sary and Milk River Development project.

Outlet of Bassano Dam. Dam and diversion canal in foreground irrigate 135,000 acres in the Eastern Irrigation District.

River, an international stream. It is also the logical first stage of an overall development involving the diversion of the Belly and Waterton Rivers, also international streams, into the St. Mary River, together with the construction of nine main and secondary reservoirs and feeder canals. This development, when completed, will put to beneficial use Canada's share of these international waters. It will also make up acute shortages in water supply to existing irrigation districts and bring 345,000 additional new acres under the ditch. It will create a tract of green acres stretching almost continuously from Spring Coulée to Medicine Hat, a distance of approximately 120 miles. Canals branching off to the southeast will serve additional large areas in the New Dayton, Middle Coulée and Milk River districts in Alberta. Then, too, the development will provide irrigable lands for an extensive colonization and rehabilitation program. It will also stabilize agriculture over a large section in the surrounding dry land area, providing a source of dependable feed supply for farmers and stockmen.

The cost of the overall development is estimated at $15,178,435. The proportion of the estimated costs as between the Dominion and the Province has not, at this writing, been determined. The recommendations contained in the report of the St. Mary and Milk Rivers Water Development Committee

A domestic water supply project. Water is pumped up 330 feet from the Saskatchewan River in the background into the canal which carries it 70 miles to an underground storage reservoir at Caron, Saskatchewan. This canal is intended to supply water to farmers en route and replenish the reservoir from which the city of Moose Jaw receives part of its water supply. N.F.B. photo

IRRIGATION DITCHES

Left, top to bottom:—
A ditching machine, showing method of constructing farm irrigation ditches.

Canal through flax field carrying water to new lands in the Rolling Hills project.

Irrigation ditch, and man irrigating alfalfa field.

Right:—
Irrigating a field of peas.

At bottom:—
Sugar beet field in the Lethbridge irrigation district, Alberta.

T. R. Melville-Ness photo

provide that "the Dominion undertake and assume as a one hundred per cent responsibility the construction of the main reservoirs and connecting canals" leaving with the Province the sole responsibility of constructing the secondary or distribution system necessary to put the waters to beneficial use. If this principle is accepted as the basis of an agreement for the division of costs the Dominion's share is estimated at $7,192,449 and the Province's at $7,985,986. The proportion of costs to be repaid to the Province by the water users is entirely a provincial matter.

The Bow River Development is another large project. It consists, among other things, of improvements, enlargements and extensions to the existing works of the Canada Land and Irrigation Company. When completed this will supplement water supplies to 55,000 acres already under irrigation and bring 180,000 additional acres under the ditch. The estimated cost of the project is $4,016,000, shared by the Dominion, the Province and the Company. As in the case of the St. Mary and Milk Rivers development, the cost of the main capital works is borne by the Dominion. On this basis the Dominion's share is estimated at $2,247,000.

Climatic and soil conditions of the St. Mary and Milk Rivers and the Bow River developments are very similar and as the two projects are adjacent, the agricultural and business life of the two communities will gain from the industrial advantage which a large area, all under irrigation, affords. Moreover, the greater part of the Bow River development lies over a natural gas field—another community asset.

The proposed Red Deer River Development is a multi-purpose project—power, irrigation, domestic water supply and stock-watering. As presently planned, the first stage in this development is a modification of what is commonly known as the "William Pearce Scheme". The key structure is a high dam on the Red Deer River twenty-five miles east of the town of Red Deer, Alberta. Plans for this dam call for a rolled earth fill 175 feet high. The reservoir will have a storage capacity of 300,000 acre feet of usable storage. The spillway will be a reinforced concrete structure, designed to discharge 125,000 cubic feet per second. The plans also provide for the construction of a hydro-power plant which will give an estimated annual output of 30,000,000 kilowatt hours for pumping and industrial uses. A main canal, with a capacity of 2,500 cubic feet per second, will carry water from the reservoir 100 miles east to secondary reservoirs, for the irrigation of lands in east central Alberta.

Soil surveys so far completed in this area indicate a possible irrigable area of 500,000 acres. It is known that this irrigable area can be extended southeast to include lands in the fertile Acadia Valley section of Alberta. When additional water supplies are made available this area can be further extended to include an area in the Province of Saskatchewan.

Due to the limited water supply of the Red Deer River, increasing demands for power and irrigation can only be met after the second or final stage of the development is completed. This phase will involve the diversion of waters from the North Saskatchewan River into the Clearwater River and from the Clearwater into the Red Deer River. It will also necessitate the construction of certain reservoirs in the mountains and the development of Buffalo Lake as the main storage reservoir. P.F.R.A. engineers are also investigating the possibility of diverting waters from the Pembina River, a tributary of the Athabaska, into the North Saskatchewan River. It is thought that this can be done through a tunnel under a short divide which separates the two rivers at a certain point; this would compensate for any waters diverted from the North Saskatchewan River into the Clearwater. The development outlined would regulate and greatly augment the water supply for power and irrigation in a section of the country where settlement has thinned down, for the most part, to a ranching basis, due to drought.

The proposed development would open up extensive areas of good lands for settlement where thousands of family-sized farms could be established. It would also provide for our expanding rural population under conditions of independence and security which irrigation farming ensures. It would provide, too, opportunities for the establishment of certain industries which naturally follow in the wake of irrigation—canning, sugar refining and the like—thereby increasing business opportunities and careers in the trades and professions.

It will be readily conceded that the orderly stage-by-stage development of these large scale projects, in keeping with the demand for expansion, based on knowledge born of experience and research, is both good engineering and sound economics.

There is the further point which needs to be stressed and which is particularly applicable to the basin-wide concept of development, namely, that projects should not be undertaken now, or in the future, merely to satisfy local or selfish interests which would jeopardize the over-all ultimate development. If this principle is observed in the case of the North Saskatchewan and Red Deer Rivers development, the vision of the late William Pearce will not be lost, because the foundations will be laid for prosperity for present and for future generations. Plans have not yet reached a stage where an estimate of costs can be given; consequently, the economics of the project has not yet been determined.

Preliminary surveys and investigations have been under way for some time as to the feasibility of constructing a high dam on the South Saskatchewan River. These investigations and studies have now reached a point where two sites have been selected

for final determination as to costs and other factors. The sites selected are 12 miles apart, situated 17 and 29 miles respectively down stream from a point on the South Saskatchewan River known as "the Elbow".

The proposed South Saskatchewan River Development is another multi-purpose project—power, irrigation, domestic water supply for the cities of Moose Jaw, Regina and intermediate points, and flood regulation. Present plans, subject to change, call for a rolled earth fill 210 feet high above the river bed. The plans also provide for a reinforced concrete spillway to discharge at least 300,000 cubic feet per second. Two power tunnels will discharge water through turbines in a power house situated immediately below the dam. The power plant will be designed for an ultimate installed capacity of 120,000 horse-power.

The dam will create a reservoir 135 miles long with a maximum depth at the dam of 190 feet. The reservoir will have a maximum capacity of approximately 7,000,000 acre feet, of which 3,000,000 acre feet will be usable storage. The proposed dam would be among the largest earth dams on the North American continent. Soil surveys so far conducted by the Soils Department of the University of Saskatchewan on areas lying immediately adjacent to the reservoir indicate 864,000 acres of land suitable for irrigation. In this connection, too, it is known for certain that there are more lands suitable for irrigation than can be irrigated from the available water supply, a circumstance which will permit a selection of the best lands and hence the most beneficial development.

The combined projects, consisting of the St. Mary, the Bow, the Red Deer and the South Saskatchewan Rivers, are all part and parcel of the South Saskatchewan River watershed. Collectively this development is one of the largest on the North American continent, embracing as it does a total of 1,845,000 acres of land, with the possibility of further expansion as need arises. Completion of this program, in conjunction with the small water development, will revolutionize agriculture on the open plains and spread its stabilizing influence across the whole economy of the nation.

Natural storage. Glacier-fed Upper St. Mary Lake, Montana, at an elevation of approximately 6,000 feet. These are the headwaters of the St. Mary River, an international stream, on which a dam is now being constructed in Canada by the P.F.R.A.

Modern Maori Education

by M. PATRICK

A FEW DAYS AGO I was guest of two young ladies at a meal in a shiningly clean cottage at a place called Whakarewarewa, near the world-famed New Zealand tourist resort, Rotorua. The meal was the normal New Zealand one of soup, meat and vegetables, and sweets, palatable and neatly served.

The unusual thing was that I was in the midst of a Maori community. My hostesses, who had cooked the meal themselves, were Maori maids of 12 and 14 years. My companions at the table were Maori boys and girls whose correctness made me remember my own manners.

A few years ago the Maori children of this community would have been living on an inadequate diet. They would not have known how to run a household in European fashion. Their ideas of hygiene and sanitation would have been primitive.

By a deliberate government policy, which has the enthusiastic support of the Maori race, all that is being changed. New Zealand's 26,000 native children are being trained for a place in the nation's life that will make them equal citizens with the whites. They have always had that equal place in law, but in the past have fallen short of equality in fact because they have not fully absorbed European ways.

Thirteen thousand of these children go to the same schools as white children, sit in the same rooms, learn the same things. The remainder attend native schools. Here the European way of living forms part of their lessons while at the same time the old Maori culture and traditions are preserved.

Whakarewarewa is a typical native school. In charge of its 214 pupils are nine teachers, five of them of the Maori race. One of them topped the New Zealand examinations in her year and the others have the same academic qualifications as white teachers. The school is housed in a modern open-air type of building, its central room being a community hall, in which films are shown and meetings held.

The children, many of whom come to the school knowing little English, begin their education in European ways immediately, by playing with European toys. The cheerful dark-eyed boys have trains, horses, and blocks to play with and for the girls there is a doll's house big enough for them to walk into and arrange.

Life becomes even more exciting as they grow older. In addition to formal education, they have sports, gymnastics, pets, gardens, and as well as these the intriguing Maori stick and string games, hakas and poi dances. The Maori has a special aptitude for working with tools, as shown by the success of the Government scheme for training returned Maori

At top:—Maori woman and child, in traditional wrap, at Rotorua, North Island.

The old-time Tohunga, *priest or teacher, is fed.*

Maoris have great artistic skill in wood carving. A carver demonstrates his craft at Rotorua.

servicemen for trades. At Whakarewarewa many boys work at the graceful traditional carving or turn their hands to making articles of furniture for their parents' homes.

Emphasis in the new education, however, is on the girls. They are being taught to accept the well run household with adequate and properly cooked meals as the normal way of life and the authorities hope that they will demand this standard when they become adults.

They learn such things as mothercraft, for among the Maoris early marriage and large families are common. But the big adventure is being placed in charge of a household, to run it on European lines. That was how I was able to dine so well at Whakarewarewa. My hostesses had for a week been in charge of the model cottage which had all the appointments of a normal home. They had kept it clean and polished, had cooked meals for up to 30 children and cut lunches for as many more, and had had charge of the finances. This experience comes to them about six times a year. All the time they are under no other supervision than the friendly eye of a teacher who occupies the cottage.

It is all play to them, an experience to be looked forward to for weeks and to be talked over for weeks more. They learn quickly and retain what they learn, for each time they take over the cottage they are better housewives. Revenue comes from charges made for meals, sixpence for dinners and threepence for cut lunches, and the girls soon learn to work within the money available.

School is a blending of all that is best of two cultures. Healthy living is stressed. Indeed special health measures are taken—the free milk that is available to all New Zealand school children is served and in addition there are doses of cod liver oil and tonic to combat the colds and influenza to which Maoris are particularly susceptible.

Education for the Maori does not stop at primary schools. Both European and native secondary schools are open to him, as is also university training. The native education policy has produced doctors and dentists and holders of university degrees.

But chiefly in the past it has been the Maori of exceptional ability who has entered a profession or who has become a skilled worker. In the future it is hoped that the same opportunities will be open automatically to the average Maori as to the average European. The Maori today is being fitted to take a full part in a European community, as well as to enjoy the fine traditions of his own race.

A beautiful carved storehouse, safely elevated, where objects of special value are kept.

Upper left and centre:—Parents are guests of their daughters at the model cottage where the latter have been keeping house all week in European fashion.

Right:—Doing the haka, *or war dance, in the tradition of their fathers.*

Below:—The daily dose of cod liver oil

Above:—Milk is supplied free to children in all New Zealand primary schools.

Above:—Weight is checked regularly

Left:—The school council meets in the school hall, the centre of community activities.

Below:—A Maori boy tending his dog.

Above:—Toys to rejoice the heart of any boy—Maori or white.

EDITOR'S NOTE-BOOK

B. J. McGuire and H. E. Freeman worked together for the first time in 1935-36 when Mr. McGuire was editor-in-chief of the University of Toronto daily publication, *The Varsity*, and Mr. Freeman was a news writer on that paper. After graduation Mr. Freeman joined the staff of The Canadian Press and during the next nine years worked as editor in bureaux from Sydney to Winnipeg with wartime excursions as a reporter with the R.C.N. on convoys and with R.A.F. Transport Command in the Middle East. Mr. McGuire continued in newspaper work for some time after graduation, then joined the staff of The Aluminum Company of Canada, Ltd., and spent the next several years in public and industrial relations work with that company in Toronto, Kingston and Montreal. They came together again in 1945 with Public and Industrial Relations Limited where Mr. Freeman is now manager of the News Bureau and Mr. McGuire is a director. Much of their present writing is of an educational nature.

* * *

George Spence, C.B.E., was born in the Orkney Islands and educated in Scotland. He came to Canada at the age of 21. Mr. Spence has had a distinguished political career; he was first elected to the Saskatchewan Legislature in 1917 and, after being twice re-elected, he resigned to enter the federal field. He successfully contested two elections to the House of Commons, after which he returned to provincial affairs to enter the Saskatchewan Cabinet, where he became Minister of Highways in 1927 and Minister of Railways, Labour and Industries in 1928. After two more elections in which he was returned to office, he became Minister of Public Works in 1934. He resigned from this appointment to take on the post of Director of the Prairie Farm Rehabilitation Act of the Dominion Department of Agriculture, with headquarters at Regina. Since writing the informative article on some aspects of P.F.R.A. activities which appears in this issue, Mr. Spence has been appointed Commissioner on the Canadian section of the International Joint Commission, upon which, in October, he relinquished his directorship of the P.F.R.A.

* * *

AMONGST THE NEW BOOKS

New Zealand, Pacific Pioneer
by PHILIP J. SOLJAK
(Macmillan, Toronto, $2.75)

ONE of the drawbacks of membership in an empire on which the sun never sets, is the fact that it is difficult to be acquainted with the more remote and antipodean of our fellow citizens. The late war and the Empire Air Training Plan gave many Canadians the opportunity of meeting and knowing some of the finest of the manhood of New Zealand, and a book about that Dominion at this time, before those kindly memories are dimmed, is both timely and valuable. Mr. Soljak, the author, is a native New Zealander who has been around and about the world sufficiently to give him balance and perspective in writing about his homeland. In this book, he sketches the geography and history of his country, summarizes its industry and trade, gives kindly attention to the frail budding of its arts and letters, and renders due tribute to the present labour government and its policies, of which he is a strong proponent. It is evident that he has both the background and knowledge to produce a very competent piece of work which can give the reader an understanding of our sister Dominion and her problems, economic and political. In politics, her homogeneous population and isolation from other states has made her an ideal testing ground for the social experiments that are so much discussed throughout the world today. Whether her experiences throughout the years to come will be a guide or a warning to other states and dominions is anyone's guess but, at any rate, this small community has the courage of its convictions and is proud to blaze the path in social consciousness and social service. Recommended reading.

* * * P.E.P.

The Assiniboine Basin
by MARTIN KAVANAGH
(Public Press Ltd., Winnipeg, $3.50)

THIS is "a social study of the discovery, exploration and settlement of Manitoba" and Mr. Kavanagh, who is a teacher at Brandon Collegiate School, has devoted a great deal of time and effort to the subject. The earlier chapters are those most likely to appeal to the general reader; later in the book one becomes involved in a series of names and minor topics of local interest only. There are interesting maps and illustrations and numerous readable and valuable extracts from early documents. It is to be hoped that Mr. Kavanagh will turn his eyes on other parts of the country where there is need for similar research in local history

DOUGLAS LEECHMAN

* * *

September issue, 1947, page 147: the illustration at bottom shows Canadian National Railways bridge, not Provencher Bridge.

The Story of Our Canadian Northland
by JOSEPH M. SCOTT

(J. M. Dent & Sons, Toronto, $1.60)

THIS book, prepared for use in the schools, is well conceived and well executed. It is written in simple language but without the somewhat offensive condescension which mars some school books. There are numerous good illustrations and a serious effort has been made to avoid the myths and errors which abound in most discussions of the far north. It is up to date, adequately indexed, and simple maps are included in the text where needed. The suggestions for practical school projects and hints for further reading are also useful additions. DOUGLAS LEECHMAN

* * *

The City of Women
by RUTH LANDES

(Macmillan, Toronto, $3.00)

THE author, Dr. Ruth Landes, is a social anthropologist who has done field work in Canada among the Ojibwa Indians, so Canadian readers may feel that they have a special interest in her new venture among the negro people of Bahia, on the east coast of Brazil. Here she hoped to find a culture in which the Negro was not looked down upon as socially inferior, where she could study him freed from the inhibitions inescapable in the United States. Whether she was quite as successful in this as she might wish is a matter to be left to the reader.

What she did find, quite unexpectedly I believe, is a most amazingly virile reproduction of native African religion transplanted to the fertile soil of South America. For a hundred years or even more, since the very beginnings of the slave trade, close contact has been maintained between the slaves and the freemen still in Africa, young men have been sent back to their native land to study the native cults, and the paraphernalia and rituals have been transferred across the ocean. Candomblé as it is known today, runs its course side by side with Roman Catholicism, with saints and minor deities inextricably interwoven. It is an amazing revelation of a side of life, of a whole system of living indeed, totally unsuspected. The book's greatest defect is an almost unbelievable one—there is not a single picture in it, though the author assures us herself that she did take some. DOUGLAS LEECHMAN

Tatoosh

by MARTHA HARDY

(Macmillan, Toronto, $3.00)

NOWADAYS we find women in so many occupations, heretofore considered the specific fields of men, that one can hardly be surprised at finding a school ma'am acting as a fire watcher and not at all surprised when she writes a book about it. Miss Hardy spent the summer of 1943 watching for forest fires, perched like an eagle in its eyrie, on Mount Tatoosh, one of the highest peaks of the Cascade Mountains in the Columbia National Forest. An intermittent sort of telephone line connected her with headquarters in the valley and with the exception of a couple of expeditions to bring in supplies, this was her only contact with the world outside for three long months. Her story contains its share of female flutterings and twitterings about thunder storms and ghostly creakings in the night which conform to what appears to be a conventional attitude of the female writer about the out of doors. Actually, Miss Hardy appears to be a very self-contained and self-reliant sort of person who took her loneliness and occasional discomforts in her stride and makes a very good and interesting story of her summer among the clouds. She has the happy faculty of taking her readers, and there should be many of them, along with her and letting them see through her eyes the majesty of dawn and sunset in the high peaks and the great panorama of mountain, glacier and clouds which surrounded her day by day. Recommended reading.. P.E.P.

* * *

Tales of the South Pacific

by JAMES A. MICHENER

(Macmillan, Toronto, $3.00)

WHEN an American Marine finds time heavy on his hands and undertakes to teach a hard-boiled Tonkinese lady, who sells curios (and a very charming daughter), how to use American slang and profanity, he finds it a far more rewarding effort than teaching the same words to a parrot. The parrot lacks the sense of timing and applicability so outstanding in his human pupil.

These tales are not all so lurid or so ludicrous as the paragraph above might suggest. They are very good tales, very well told. Incidentally, the author attains one goal which, I feel fairly confident, he did not set out for. He makes the stupendous effort exerted in the South Pacific by the United States credible, he enables one to visualize it and appreciate it fully, with no word of boasting or vainglory, without any "biggest in the world".

Mr. Michener writes from first-hand knowledge of the area, for his position was that of Senior Historical Officer, and from first-hand knowledge of the men, too, for he was there with them. Above all things, he has that first of all desiderata, good tales to tell—and he tells them well. DOUGLAS LEECHAMN

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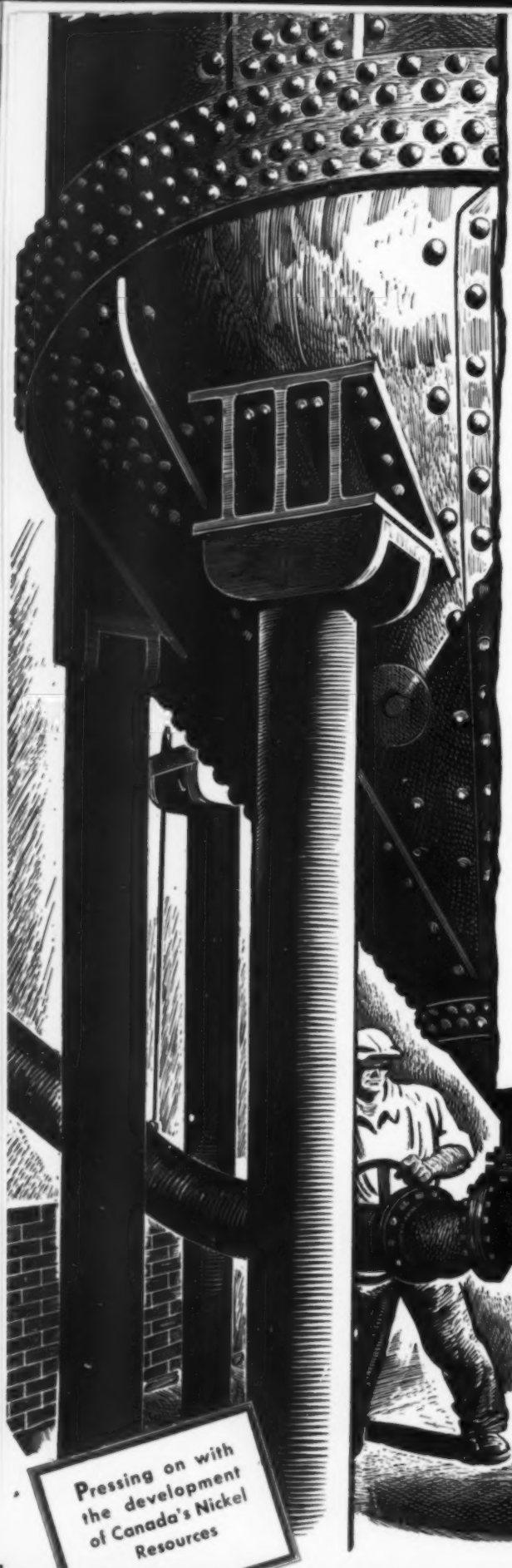

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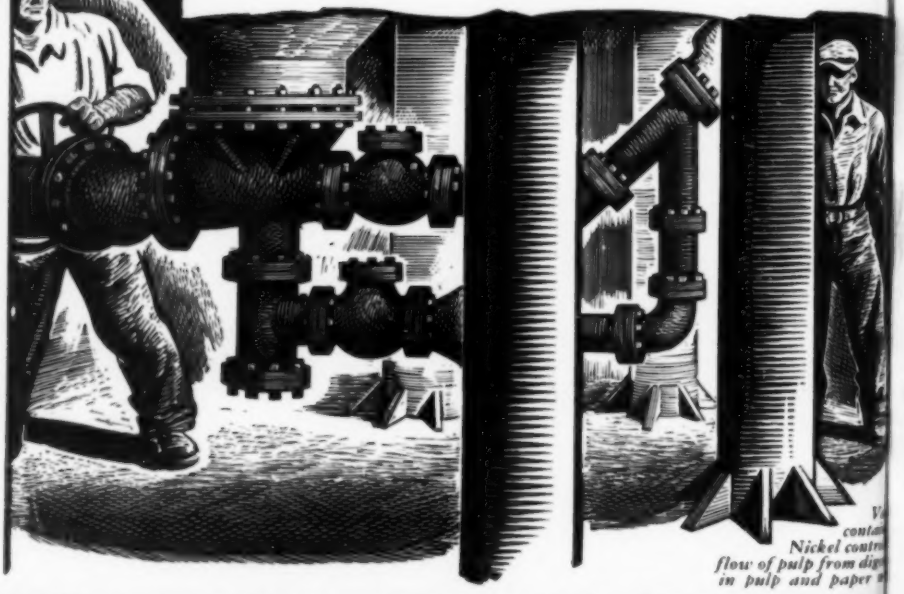

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